# APPENDIX B

# Kinnetic Labs Sediment Sampling Project Summary

Appendices available at:

ftp://ftp.merkelinc.com/Merkel/Batiquitos

2011 Batiquitos Lagoon Maintenance Dredging

Bidlog 2011-01

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# SUBJECT: BATIQUITOS LAGOON SEDIMENT SAMPLING PROJECT SUMMARY

This Summary is being provided to you in satisfaction of the Batiquitos Lagoon Sediment Sampling Project that was completed in months of January/February 2010. The purpose of this project was to define the sand thickness throughout the lagoon and identify the quality of sand that is suitable for the maintenance dredging program. Throughout this summary the Batiquitos Lagoon will be referred to as three separate regions, Western, Central, and Eastern. Each region is defined by local roadways or railroad crossings. The Western Region is defined by U.S. Highway 101 and the railroad crossing, the Central Region is defined by the railroad crossing and the I-5 Freeway, and the Eastern Region east of the I-5 Freeway. The methods and results discussed in this summary cover sub-bottom profiling, hydro probing and vibracoring.

# SUMMARY

Kinnetic Laboratories, Inc. along with our subcontractor Environmental Data Solutions preformed a sub-bottom profile of Batiquitos Lagoon on January 16-18, 2010. The results of the sub-bottom profile show that in the Central and Eastern Regions of the lagoon, a large part of the lagoon sediment surface was covered with sub-aquatic vegetation (eelgrass). This vegetation would not allow for the sub-bottom profiling equipment to penetrate the sediments. In addition to the sub-aquatic vegetation, biogenic gas was also located within these regions. Both the sub-aquatic vegetation and biogenic gas created interference with the profiling equipment resulting in inability to differentiate between the types of sediments found. The Western Region of the Lagoon was relatively free from sub-aquatic vegetation and biogenic gas and large sand deposits were identified throughout this region.

On January 28, 2010, Kinnetic Laboratories, Inc. staff, Tim Fleming, met with California Department of Fish & Game (Department) Manager, Tim Dillingham, to determine the locations of 31 areas within the lagoon to be probed for sand thickness.

In February, 2010 Kinnetic Laboratories, Inc., retrieved vibracores at 31 different locations (Map 1) within the lagoon with a 4-inch diameter vibracore unit. Each core taken was brought to the surface to be documented with photographs, detailed notes and subsamples for grain size analysis if sand was present. At most of the locations we observed a clear transition between the sediment (Sand/Clay interface) layering. For the Western and Eastern Regions the core samples alone were not enough to determine the sand thickness down to 18 feet below the sediment surface. Hydro probing was used to in these instances to determine the extent of the sand deposits.

Once the sand sampling was completed, Fish & Game and Kinnetic Laboratories met on February 23, 2010. This meeting identified which core samples would be sent to the lab for grain size analysis. Twenty one samples were identified for analysis (HP1-8, 12-14, 19, 24, and 28-30; VC1-3; and BC1-2). Grain size analysis results showed all core samples, with two exceptions, were composed of 90% or greater sand. The two exceptions, sampling locations HP-14 and HP-29, were slightly less than 90% sand with measured values of 88.5% and 88.4%, respectively.

Sand volumes and location were calculated based on all the core information, sub-bottom profiling and grain size analysis. The sand volumes (Table A) represent the total volume of sand between the top of the sediment surface and the sand/clay interface below the sediments surface, except in the Eastern Region which indicates the volume of sand under the 2.3 -3.4 feet of a top layer of silty clay.

Table A - Sand Volumes

Areas	Cubic Yards
Western Region	219,849
Central Region	310,005
Eastern Region	22,079

It should be noted that all sand volumes are an approximation and the sand thicknesses at each sample location are only correct for that sampling time and day. Kinnetic Laboratories, Inc. and its subcontractors are making an educated guess to the profiling of the sediments in the lagoon based on the information obtained during this project. The actual condition that could be encountered in the future may vary from this summary.

# **METHODS**

Two different methods were used to directly the determine the sand thickness in Batiquitos Lagoon. Every location within the lagoon was cored with a 4-inch vibracore. Each core was examined to determine sand thickness or where the mud sand interface was located below the sediment. If the cored material was not able to determine this interface, hydro probing was used to determine the depth of sand down to 18 feet below the sediment surface of the lagoon. Thirty-three cores and 8 hydro probes were used to determine the extent of the sand quality within the lagoon.

Grain size analysis was performed on those cores with adequate sand thickness (+2 feet) over the underlying clays and silts. These determinations were made during the February 23, 2010 meeting with Tim Dillingham of the California Department of Fish & Game. The following 21 locations were slated for grain size were HP1-8, 12-14, 19, 24, and 28-30; VC1-3; and BC1-2.

#### **VIBRACORING**

Kinnetic Laboratories performed a vibracore at all locations within the lagoon(HP &VC Locations) excluding the beach cores, which were cored by hand. All cores were logged, photographed and their GPS locations recorded. The vibracore sampling was conducted from Kinnetic Laboratories' small modular barge equipped with a collapsible quadrapod, an electric winch, and a moonpool suitable for handling the coring equipment. The modular barge was assembled on site and pushed into the water to provide access to Lagoon.

Kinnetic Laboratories' vibracore consists of a vibrating unit which has two counter-rotating motors encased in a waterproof aluminum housing. A three-phase, 240-volt generator powers drives the motor. A 4-inch diameter aluminum coring tube, a stainless steel cutting tip, and a stainless-steel core catcher are attached to the water proof housing and Inserted into the core tubes were food-grade clean polyethylene liners.

The vibracore head and tube were lowered via the winch. The core tube was allowed to penetrate the surficial materials below the mud line as far as possible under the static weight of the vibracore unit. The unit was then vibrated until it reaches project depth or until the vibracore is rejected from further penetration. Once refusal was encountered, any material obtained, was used for testing and the reason for refusal was

#### Vibracore deployment





noted in the field log.

When penetration of the vibracore was complete, power was shut off to the vibra-head, and the vibracore was brought aboard the vessel. A check valve located on top of the core tube reduces or prevents sediment loss during pull-out. The length of sediment recovered was noted by measuring down the interior of the core tube to the top of the sediment. The core tube is then detached from the vibra-head, and the core cutter and catcher are removed. Afterwards, the core liners are removed and processed on board the vessel.

Cores obtained were processed by removing the core liners containing the sediments from the core barrel. The cores were then exposed, logged as to strata present, and sub-sampled by longitudinal scrapes to obtain representative subsamples for particle size analyses.

#### Hydro Probing

Hydro probing was performed by injecting water through a PVC pipe at the surface into the sediment below and allowing water to return back to the surface through a slightly smaller PVC pipe. The water injection causes the surrounding sediment layer to hydrolyze and then forced to the surface. The sediment that came up from the bottom was captured in a clean bucket for inspection. This method of bringing sediment to the surface does not allow for grain size testing because it washes away the finer particles. It does, however, provide an ability to determine what type of material is in the area. This method was only used at the 8 HP locations in both the Western and Eastern Regions of the lagoon.



**Hydro Probe Sediment Retrieval** 

#### **SUB-BOTTOM PROFILING**

These methods are in Appendix D

#### PARTICLE SIZE ANALYSIS

All particle size analysis was performed by GeoSoils, Inc. The methods used were as follows:

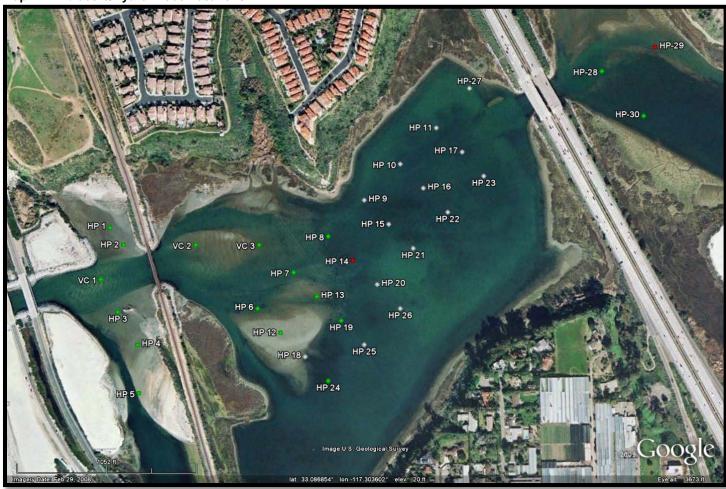
- Sieve analysis & #200 wash
  - o ASTM D 422 & ASTM D 1140

### RESULTS

Kinnetic Laboratories took 31 vibracore (Map 1) with in Batiquitos Lagoon and 2 beach core samples. The Lagoon cores were divided amongst 3 distinct Regions of the Lagoon (Western, Central, & Eastern). The Western Region had 6 cores, the Central Region had 22 cores, the Eastern Region had 3 cores, and there were 2 beach cores taken. Of these 33 core samples Kinnetic Laboratories tested 21 core samples for grain size analysis. Most of the cores tested were concentrated in the western area of the Central Region along with all the Western Region core sites. Each beach core was also analyzed for grain size. In the Eastern Region, each of the three cores were found to have good quality sand 2 to 3 feet below some surface silts and clays. The underlying sand was tested for grain size analysis. All of the sand tested in the Lagoon, with two exceptions, was found to be composed of 90% or greater sand. The two exceptions, HP14 and HP29, were composed of 88.5% and 88.4% sand, respectively.



Map -1 - Vibracore/Hydro Probe Locations



Core Locations (Green = Grain Size > 90% sand, Red = Grain Size < 90% sand, White = No Sample Taken)

#### **WESTERN REGION**

All six vibracore samples taken in this region were analyzed for grain size. However due to density of sand in this area the vibracore was not able to reach the 18 feet required to determine the sand thickness. At these locations (HP1, HP2, HP3, HP4 & HP5), a hydro probe was used to examine material down to 18 feet below the sediments. Sand was discovered at thes depths, with the exception of HP5 where the hydro probe hit a layer of impenetrable rock at 12.1 feet below the sediment surface. In addition, at location VC1 the sand thickness was found to be 12.5 feet thick. All grain size analyses for this region, displayed a composition of greater than 90% sand (Table 1).

Table 1. Western Region Core Location & Grain Size

Pt ID	Latitude	Longitude	Sand Thickness	% Gravel	% Sand	% Silt & Clay	Vertical Composite*
HP1	33.088556	117.310611	18.0+		95.7%	4.3%	0-12.1
HP2	33.088278	117.310361	18.0+	0.2%	94.2%	5.6%	0-12.9
HP3	33.087194	117.310472	18.0+	0.4%	97.5%	2.1%	0-11.8
HP4	33.086667	117.310194	18.0+	0.5%	97.6%	1.9%	0-11.5
HP5	33.085889	117.310056	12.1		93.5%	6.5%	0-11.2
VC1	33.087722	117.310806	12.5		98.9%	1.1%	0-12.0

\*Vertical Composite indicates the interval tested for grain size analysis in feet.



#### CENTRAL REGION

Within the Central Region of the lagoon 22 vibracore samples were taken. Most of the core samples were found to have sand in the surface sediments. All core samples within this region displayed underlying clays and silts. The layers below the sand were noted in the core logs (Appendix A) and discarded. Grain size testing was performed at only at 10 of the 22 core locations. These locations (HP6-HP8, HP12-HP14, HP19, HP24, & VC2-VC3)were all concentrated in the western half of the Central Region. Grain size analyses was performed on the top sandy sediments and displayed a composition of greater than 90% sand, with the exception of HP14, which measured 88.5% sand (Table 2).

Table 2. Central Region Vibraore Locations & Grain Size

Pt ID	Latitude	Longitude	Sand Thickness	% Gravel	% Sand	% Silt & Clay	Vertical Composite*
HP6	33.087250	117.307778	5.7		97.3%	2.7%	0-5.7
HP7	33.087833	117.307083	3.7		96.8%	3.2%	0-3.7
HP8	33.088417	117.306417	5.5		90.3%	9.7%	0-5.5
HP9	33.089000	117.305722	0.0			NA	
HP10	33.089583	117.305028	4.5			NA	
HP11	33.090167	117.304333	1.1			NA	
HP12	33.086861	117.307333	8.1		96.2%	3.8%	0-8.1
HP13	33.087444	117.308139	6.6		94.3%	5.7%	0-6.6
HP14	33.088028	117.305944	4.2		88.5%	11.5%	0-4.2
HP15	33.088611	117.305250	2.1			NA	
HP16	33.089194	117.304583	1.7			NA	
HP17	33.089778	117.303833	3.4			NA	
HP18	33.086472	117.306861	3.3			NA	
HP19	33.087056	117.306167	5.7		92.6%	7.4%	0-5.7
HP20	33.087639	117.305472	2.1			NA	
HP21	33.088222	117.304778	1.0			NA	
HP22	33.088806	117.304111	1.2			NA	
HP23	33.089389	117.303417	1.3			NA	
HP24	33.086083	117.306417	5.9		92.5%	7.5%	0-5.9
HP25	33.086667	117.305722	0.0			NA	
HP26	33.087250	117.305028	1.4			NA	
HP27	33.090806	117.303694	0.0			NA	
VC2	33.088278	117.308972	8.7		98.2%	1.8%	0-8.7
VC3	33.088278	117.307750	8.2		96.9%	3.1%	0-8.2

<sup>\*</sup>Vertical Composite indicates the interval tested for grain size analysis in feet.

#### **EASTERN REGION**

Within the Eastern Region just 3 vibracore samples were taken. Each of core samples displayed between 2.3 to 3.4 feet of silty clay in the surface material which revealed an underlying fine, gray, hard compacted sand. This sand layer was not able to be penetrated below 10 feet of depth so hydro probing was used to determine how deep the sand layer extended below the surface sediments down to 18 feet. Each of the hydro probing found that the sand like material extended down to 18 feet, however there appeared to be more fine associated with depth. All three core samples were analyzed for grain size and ranged from 88.4% to 92.9% sand (Table 3).

Table 3. Eastern Region Core Locations & Grain Size

Pt ID	Latitude	Longitude	Sand Thickness	% Gravel	% Sand	% Silt & Clay	Vertical Composite*
HP28	33.091083	117.301139	0.0		91.2%	8.8%	3.3-8.7
HP29	33.091472	117.300111	0.0		88.4%	11.6%	2.3-10.0
HP30	33.090361	117.300333	0.0		92.9%	7.1%	3.4-10.5

<sup>\*</sup>Vertical Composite indicates the interval tested for grain size analysis in feet.



#### **BEACH CORES**

One foot cores were taken at two nearby beach locations. The first location, at North Ponto Beach (BC-1), was found to consist mostly of beach stones (cobbles) and patchy spots of sand and gravel. The second location, at South Ponto Beach (BC-2), is a very wide beach and was composed of 99.4% sand (Table 4).

Table 4. Beach Core Location & Grain Size

Pt ID	Latitude	Longitude	Sand Thickness	% Gravel	% Sand	% Silt & Clay	Vertical Composite*
BC1	33.114278	117.324611	1.0	51.4%	48.3%	0.3%	0-1
BC2	33.085722	117.312583	1.0		99.4%	0.6%	0-1

<sup>\*</sup>Vertical Composite indicates the interval tested for grain size analysis in feet.

#### SUB-BOTTOM PROFILING AND BATHYMETRIC SURVEY

The results for sub-bottom profiling and bathymetric survey are in Appendix D

# REFERENCES

ASTM D422 - 63(2007) Standard Test Method for Particle-Size Analysis of Soils

ASTM D1140 Standard Test Methods for Amount of Material in Soils Finer than No. 200 (75-µm) Sieve

# **APPENDENCES**

APPENDIX A - BORING (CORE) LOGS

**APPENDIX B - CORE PICTURES** 

APPENDIX C - PARTICLE SIZE ANALYSIS

APPENDIX D - SUB-BOTTOM PROFILING AND BATHYMETRIC SURVEY REPORT

APPENDIX E - SURVEY MAPS

APPENDIX F – AUTOCAD FILES

APPENDIX G - GIS FILES

